AMENDMENTS TO THE CLAIMS:

Please amend claims 1, 2, 5, 6, 7, 8, 11, 13, 15 and 17 as follows. This listing of claims will replace all prior versions, and listings of claims in the application:

LISTING OF CLAIMS:

1. (Currently amended) A method of verifying a projected image within a three-dimensional view plane of an augmented-reality display system as a preselected movable real object disposed in three-dimensional free space, whereby the object may be employed as an interface tool for the system, comprising steps of:

identifying a representative characteristic of the movable real object within the three-dimensional view plane wherein the representative characteristic comprises shape and location of the object and is exclusive of preselected marked standards~~,~~ ~~such as registration marks~~ and printed identifiers;

determining dimensional aspects of the movable real object from the projected image;

computing a corresponding dimensional identity and location of the movable real object at an object point relative to the view plane; and,

verifying whether the dimensional identity and location are reasonably consistent with predetermined standards for the object.

2. (Currently amended) The method as claimed in claim 1 wherein the preselected movable real object comprises a reference panel such as a screen, tablet or piece of paper and the identifying includes recognizing a corner of the panel.

3. (Original) The method as claimed in claim 2 wherein the determining comprises calculating distances between corners and a center point of the reference panel.

4. (Original) The method as claimed in claim 3 wherein the computing comprises converting the calculated distances to the dimensional identity and location based on an assumption that the reference panel is structurally flat.

5. (Currently amended) The method as defined in claim 1 wherein the verifying includes testing from at least one of the tests of (a) whether the movable real object has expected dimensions or proportions, (b) whether the corners are right angles, (c) whether a center point matches when calculated from distinct sets of the corners, (d) whether the corners are generally within a common plane, and (e) whether the movable real object lies within an expected viewing range.

6. (Currently amended) The method as defined in claim 1 wherein the preselected movable real object is comprised of three equidistant line points disposed in free space and the determining comprises detection of projected dimensions of the three equidistant line points.

7. (Currently amended) The method as defined in claim 6 wherein the computing comprises calculating ~~object~~ X, Y and Z coordinates in real space of the movable real object at the object point based on the projected dimensions of the three equidistant line points in the view plane and known augmented-reality display system geometric dimensions.

8. (Currently amended) A method for identifying a movable real piece of paper disposed in free space in a variable three-dimensional viewing area of an augmented-reality display system comprising steps of:

identifying an object at a viewing plane in the three-dimensional viewing area having a characteristic representative of the piece of paper wherein the characteristic is exclusive of preselected registration marks and printed identifiers;

locating a plurality of corners of the object;

calculating a dimensional representation of the object in the viewing plane from the locations of the corners;

unprojecting the dimensional representation to calculate a plurality of object coordinates representative of a size of the object and a distance of the object from the viewing plane; and,

comparing the object coordinates with predetermined standards indicative of the piece of paper for verifying the object as the piece of paper.

9. (Original) The method as defined in claim 8 wherein the calculating includes identifying a diagonal between the corners comprised of three equidistant line points.

10. (Original) The method as defined in claim 9 wherein the identifying includes identifying a center point of the diagonal.

11. (Currently amended) The method as defined in claim 8 wherein the unprojecting includes calculating ~~the object~~ X, Y and Z coordinates in real space of the object based on dimensions of the movable real object in the viewing plane and display system geometrics.

12. (Original) The method as defined in claim 8 wherein the comparing includes testing from at least one of the tests of (a) whether the object has expected dimensions or proportions, (b) whether the corners are right angles, (c) whether a center point matches when calculated from distinct sets of the corners, (d) whether the corners are generally within a common plane, and (e) whether the object lies within an expected viewing range.

13. (Currently amended) An augmented-reality display system for verifying a presence of a predetermined and movable real reference frame in a three-dimensional free space within a system image, comprising:

a movable real item disposed in free space disposed within a three-dimensional view plane of the system;

a sensing device for identifying from the view plane a characteristic of the movable real item associated with the predetermined reference frame wherein the characteristic is exclusive of preselected registration marks and printed identifiers; and,

a controller for determining dimensions of the real item within the view plane, for computing a corresponding dimensional identity and three-dimensional location of the real item relative to the view plane, and for verifying whether the dimensional identity and location correspond with the presence of the predetermined reference frame.

14. (Original) The system as defined in claim 13 wherein the real item comprises a piece of paper.

15. (Currently amended) The system as defined in claim 14 wherein the controller includes means for computing three-dimensional object X, Y and Z coordinates of the piece of paper disposed in free space relative to the view plane.

16. (Previously presented) The system as defined in claim 14 wherein the controller includes means for testing from at least one of the tests of (a) whether the object has expected dimensions or proportions, (b) whether the corners are right angles, (c) whether a center point matches when calculated from distinct sets of the corners, (d) whether the corners are generally within a common plane, and (e) whether the object lies within an expected viewing range.

17. (Currently amended) The method as defined in claim 8 wherein the unprojecting comprises unprojecting a plurality of dimensional representations of the object attributable to three-dimensional movement of the object in the variable viewing area.

THE OFFICE ACTION

Applicants have now had an opportunity to carefully consider the Examiner's comments set forth in the Office Action of October 8, 2003.

Claims 1-7 were objected to under MPEP § 2173.05 (d) as being indefinite.

Claims 1-7, 13, 14 and 16 were rejected under 35 U.S.C. §102(e) as being anticipated by Kuzunuki et al (US 6,266,057).

Claims 8-12, 15 and 17 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kuzunuki et al (US 6,266,057) in view of Wilson et al (US 6,278,479).

The Examiner will appreciate that the claims have been amended to better distinguish the subject invention from the teachings of the references of record.

Reexamination and reconsideration are respectfully requested.

The Present Application

For purposes of brief review, the subject invention is directed to an improved augmented-realty display system which can locate a preselected moveable real object in a wide variety of positions within three-dimensional view plane. More particularly, it is envisioned that the subject invention will comprise a method of verifying a projected image within a three-dimensional view plane of the augmented-realty display system as a preselected moveable real object. This is extremely useful in a situation where the reference item is a piece of paper in a variable three-dimensional viewing area, such as may be held in a hand of a user as opposed to be only disposed on a desk top, and where the augmented-realty display is implemented through a headset or viewing glasses as disclosed in the specification. It is pertinent to note that in such an implementation, the view point is not fixed, but will usually move in free space in accordance with the head movement of the user. It is intended that the viewpoint will shift as the user changes his/her viewpoint as a matter of comfort or work need. In addition, the reference item at the "object point" of FIG 7 is intended to be moveable within a three-dimensional variable viewing area of the augmented-realty display system. Such movement again is to better accommodate the comfort and needs of the user working with three-dimensional moveable objects within the variable viewing area. The ability to accommodate the freedom of movement of the viewing point and the

referenced object is an important operational advantage of the subject system over the below cited references.

The References of Record

The reference to **Kuzunuki et al** relied upon by the Examiner relates to an information processing system which operators can use to directly handle image objects displayed on a relative fixed desk display surface (a virtual desktop) inserted into a desk by using actual objects placed on the desk (e.g. a facsimile machine). To enable direct touch of image objects and use of actual objects as man-machine interface parts, the attributes (the number of areas, area and ambient length are combined for recognition) of the actual objects must be defined in advance so that the processor can understand what they mean (see Column 17, Lines 1-12). Actual objects are projected by a fixed overhead camera and an operator managed menu stores the actual object attributes to be interfaced with the display images. Based on these attributes, characteristic point coordinates (e.g. gravity center, center, corner and/or endpoints, see Column 9, Lines 4-25) are determined for the actual object. Further, hold and release hand gestures must also be defined in advance so that the operator can directly interface with the image object or actual object without specifying a menu and an icon.

Although the actual objects of the desk surface maybe moved by an operator on the desk, their distance positioning relative to the camera will not change. As such, there is no need for their identification and distinguishment within a variable viewing area from other objects not comprising the intended reference tool.

For example, assume that a facsimile machine is placed on the desk as an actual object and a data file is opened on the display unit as an image object. When the operator moves this data file in the facsimile direction, the characteristic point coordinates of the image object approach that of the actual object and the information processor performs facsimile send processing on the assumption that the data file is to be sent in the facsimile. In another example, when the characteristic point (corner or center of gravity) of an image object approaches a characteristic point (center of gravity) of a file part, which is an actual object, the image object is highlighted and the file operation acceptance action is displayed. When the hand release gesture operation of the image object is performed by the operator, the file operation is executed and the image object disappears.

Accordingly, it can be appreciated that Kuzunuki et al were not operable, nor intended to operate, in a system where the reference object is located other than on the desk display surface.

The reference **Wilson et al** relied upon the Examiner relates to duel realty system comprising an apparatus for merging real and virtual images in which computer generated objects and images similar to those created by virtual reality systems appear to the user in the real world. Similar to virtual reality, the dual reality environment is presented to the user by way of a headset or visor which provides a virtual image, and, in addition thereto, presents a stereoscopic view of the real environment through the employment of a pair of cameras coupled to the visor through a computer to present a stereoscopic view of the real environment to the user through the visor. The computer performs triangulation calculations which determine the distances from the visor to the selected navigational points to determine the position and orientation of the visor.

For example, a computer generated object, such as a ball, viewed through the dual reality visor appears to float in front of the wearer. The observed surroundings are coupled to the visor display from the cameras and present a view of the actual surroundings as opposed to a computer generated display (i.e., a computer generated display of the actual surroundings).

In order to perform the method of the above invention, Wilson et al (a) determine the location and orientation of the dual reality system in a real three-dimensional space utilizing random points selected from an observed field of view; (b) superimpose computer generated objects with images of the real three-dimensional space; and (c) interact such computer generated with the real environment and with the user identifying surfaces (such as walls, tables, panels, hands, etc.) in three-dimensional space.

Accordingly, it can be appreciated that Wilson et al were not operable, nor intended to operate, in a system where a preselected moveable object in three-dimensional free space (e.g. a piece of paper) is intended for use as a reference object for displaying an electronically generated image and/or text to the user in the actual real world as compared to a computer generated display of the real world.